

# Fact Sheet

## BIOREMEDIATION OF HYDROCARBON-CONTAMINATED SOIL IN NORTHERN CLIMATES

### PROBLEM

Extreme climatic conditions create unique problems for conventional technologies. Short operating seasons combined with low-temperature-unique chemical, physical and biological phenomena challenge existing methods.

### SOLUTION

To develop cost-effective solutions for bioremediation techniques in northern climates, we are exploring three approaches:

- Enhanced landfarming
- Recirculating leach bed
- Infiltration gallery trickling filter with groundwater recycling

All three technologies are being demonstrated at the same field site. Modifications to mechanical systems were designed to solve difficulties associated with extremely low temperatures and to allow system shut-down during the winter. These engineering solutions are integrated with an intensive scientific monitoring effort focused on field measurements of microbial kinetics. The natural variability in the field biodegradation rates is being exploited to estimate the potential for identifying and removing limitations to bioremediation. We have demonstrated the benefits of low-cost, readily implemented biotreatment applicable to cold regions and the problems related to in-situ treatment systems. Extensive field monitoring has clearly shown the inherent difficulty caused by spatial variability in obtaining readily interpreted field data. We are applying geostatistical techniques to address this limitation.

This project is a Corps of Engineers Construction Productivity Advancement Research (CPAR) project, which is a cost-shared, cooperative research program designed to enhance the competitiveness of the United States construction industry. The U.S. Army Cold Regions Research and Engineering Laboratory (USACREL) is partnering with the Alaska Department of Transportation and Public Facilities (AKDOT & PF).

### RESULTS

Degradation rates within the landfarm varied sevenfold. This variance may be attributed to changes in soil nutrients and moisture potential. Results have suggested that treatment in one season is feasible. The approximate cost for this technology has been \$20 to \$40 per cubic yard. Use of the recirculating leach bed was deferred due to a break in the liner, but a similar system remediated highly contaminated soil at a remote site for approximately \$150 per cubic yard. The petroleum hydrocarbon concentrations in the infiltration gallery sampling wells have decreased to acceptable levels.

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**April 1995**